25X1A2g

25X1A2g

F20206 [redacted]

CONFIDENTIAL
Security Information

26 Mar 53

INDEX

25X1A2g

SUBJECT: [redacted] - Superiority of US Graphite Anodes

SOURCES: [redacted] 25X1X

25X1X6 REFS: [redacted]

25X1A2g

1. There are several reasons for the superiority of US-made graphite anodes used in both mercury cells and diaphragm cells for the production of chlorine and caustic soda, over those produced by European makers.

2. Graphite anodes for both types of chlorine cells have as their principal raw material in the US, petroleum coke of high quality. European makers must use either low grade petroleum coke or coke-oven coke or mixtures. The use of high grade petroleum coke, in addition to yielding anodes of better structure, strength, conductivity, and corrosion resistance, produces an anode of low vanadium content. Vanadium is a particularly bad actor in mercury cells. It migrates from the anode to the mercury cathode where it causes the liberation of hydrogen instead of the deposition of sodium. This hydrogen mixes with the effluent chlorine to form explosive mixtures.

3. The essential steps in the anode manufacturing processes in use in the US are (a) addition of binder pitch to crushed petroleum coke, (b) formation of the anode by extrusion, (c) baking, (d) impregnation with additional pitch, (e) baking, (f) graphitizing. European producers omit steps (d) and (e) as far as is known. These steps increase the normal graphite density from about 1.50 to 1.60 or 1.65, increase the mechanical strength and conductivity, and reduce the porosity.

4. An additional step is taken in the manufacture of vertical anodes for diaphragm cells which consists in the impregnation of the graphitized anode with linseed oil, followed by oxidation of the oil by newer methods which are now trade secrets. It is presumed that dryers are incorporated in the oil, but methods used to control exactly the right porosity are not known. This step is not employed by European manufacturers but may be used by some individual chlorine plants. An obsolete process was disclosed to the Soviets in 1937 [redacted]. This treatment perhaps doubles the anode life compared with untreated anodes, but at some expense in higher power consumption. It is not applicable to horizontal mercury cell anodes, however, because anodes so treated produce serious overvoltage in the cell, which is not a problem on vertical anodes from which the chlorine gas disengages freely.

25X1A [redacted] 25X1A

5. The mechanism of the destruction of graphite anodes in chlorine cells is exceedingly complex and is not very well understood. The explanation considered most probable is that some hydroxyl ions liberated at the anode react with the graphite to form carbon dioxide which appears in the chlorine gas and which is a measure of the anode destruction. With high density graphite anodes in mercury cells and with oil impregnated anodes in the diaphragm cells, this reaction is confined very largely to the surface. In

CONFIDENTIAL
Security Information

APR 8 1953

the more porous and less dense anodes turned out by European manufacturers, this reaction also goes on within the anodes resulting in spalling and eventual disintegration. It appears to be a form of combustion of the graphite and binder.

6. We have very little information about the quality of anodes produced by European manufacturers. It is well known, however, that European chlorine manufacturers prefer US anodes and purchase them to the extent that dollar exchange is available.

- end -

graphite anodes
52-49.2

520 W. Europe

Int. Rel.
53